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United States
Department of
Agriculture

Forest Service

Rocky Mountain
Forest and Range
Experiment Station

Fort Collins,
Colorado 80526

A Floristic Inventory of the Plant Communities of the San Francisco Peaks Research Natural Area

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General Technical Report
RM-96



Abstract

In this study area, covering 1,024 acres of alpine and subalpine vegetation on the west slopes of Humphreys Peak in Coconino County, Arizona, 129 species of vascular plants were found within nine plant communities or habitat types, as classified by Moir and Ludwig.

A Floristic Inventory of the Plant Communities of the San Francisco Peaks Research Natural Area¹

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¹Research reported here was funded by the Rocky Mountain Forest and Range Experiment Station and Northern Arizona University, Flagstaff, under contract 53-82FT-8-19 between U.S. Department of Agriculture Forest Service and the authors. The Station's headquarters is in Fort Collins, in cooperation with Colorado State University. Supervision was provided by Robert C. Szaro, project scientist in RM-1710, at the Station's Research Work Unit at Tempe, in cooperation with Arizona State University.

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A Floristic Inventory of the Plant Communities of the San Francisco Peaks Research Natural Area

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INTRODUCTION

The San Francisco Peaks Research Natural Area (hereafter referred to as the SFPRNA or the Natural Area) was established in 1935. It reserves, for future study, representative alpine and subalpine communities in northern Arizona. One of the original criteria for selecting the present location of the SFPRNA was to protect a representative sample of bristlecone pines (*Pinus aristata*). These trees occur nowhere else in the state of Arizona except on the San Francisco Peaks. Within the Natural Area are nearly pure stands of Engelmann spruce (*Picea engelmannii*) and bristlecone pine, and a small portion of the only alpine tundra in Arizona. This study defines the plant communities within the Natural Area and includes a checklist of the vascular plants growing within its boundaries (appendix A). This will provide baseline information for all future research done on the San Francisco Peaks Research Natural Area.

The first biological survey party to traverse the Natural Area was headed by C. Hart Merriam (1890), who collected the biota of the San Francisco Peaks during the summer of 1889. His base camp was at Little Springs, which lies about 1.5 miles northwest of the SFPRNA. Between 1937–39, E. L. Little (1941) collected extensively in the alpine tundra of the San Francisco Peaks reporting 49 alpine species. Moore (1965) added two species to the known alpine flora, and Schaack (1970) expanded the number of known species of the alpine tundra to a total of 82. Paulik (1979) reported 189 species of vascular plants for the subalpine spruce-fir forest complex of the San Francisco Peaks. And, the San Francisco Peaks were included by Moir and Ludwig (1979) in their classification of habitat types of the spruce-fir and mixed coniferous forests.

STUDY AREA

The SFPRNA is on the west slope of Humphreys Peak about 15 miles (24 km) north of Flagstaff, Arizona. The site (fig. 1), which includes one whole section and nearly two-thirds of another, covers 1,024 acres.³ The southern edge of the Natural Area is 0.8 miles north and 0.2 miles east of the Arizona Snow Bowl. It replaces an earlier Natural Area that was adjacent to the Arizona Snow Bowl. In 1966, that portion of the Natural Area located in Section 31, was deleted and a portion in Section 19 was added. Section 30 has remained intact since 1935.

³SFPRNA covers section 30 and two-thirds of section 19 in Township 23N, Range 7E.

Elevation ranges from 9,100 feet (2,800 m) at the north-west corner to about 12,100 feet (3,700 m) at the south-east corner. The site is characterized by steep, mountainous terrain, including several parallel canyons and talus slopes which drain westward toward the Bismarck Lake area (fig. 2). Two unmarked but well-worn foot trails traverse the SFPRNA, each leading towards Humphreys Peak in a meandering southeasterly direction. Two abandoned 4-inch pipelines are still intact in lower White Horse Canyon and in the two adjacent canyons to the south. These pipelines, which were installed in the late 1940's to carry water to livestock on private lands northwest of the SFPRNA, connect with springs in the alpine tundra below Humphreys Peak (fig. 3). Their removal would be impractical and would cause unnecessary damage to the terrain.

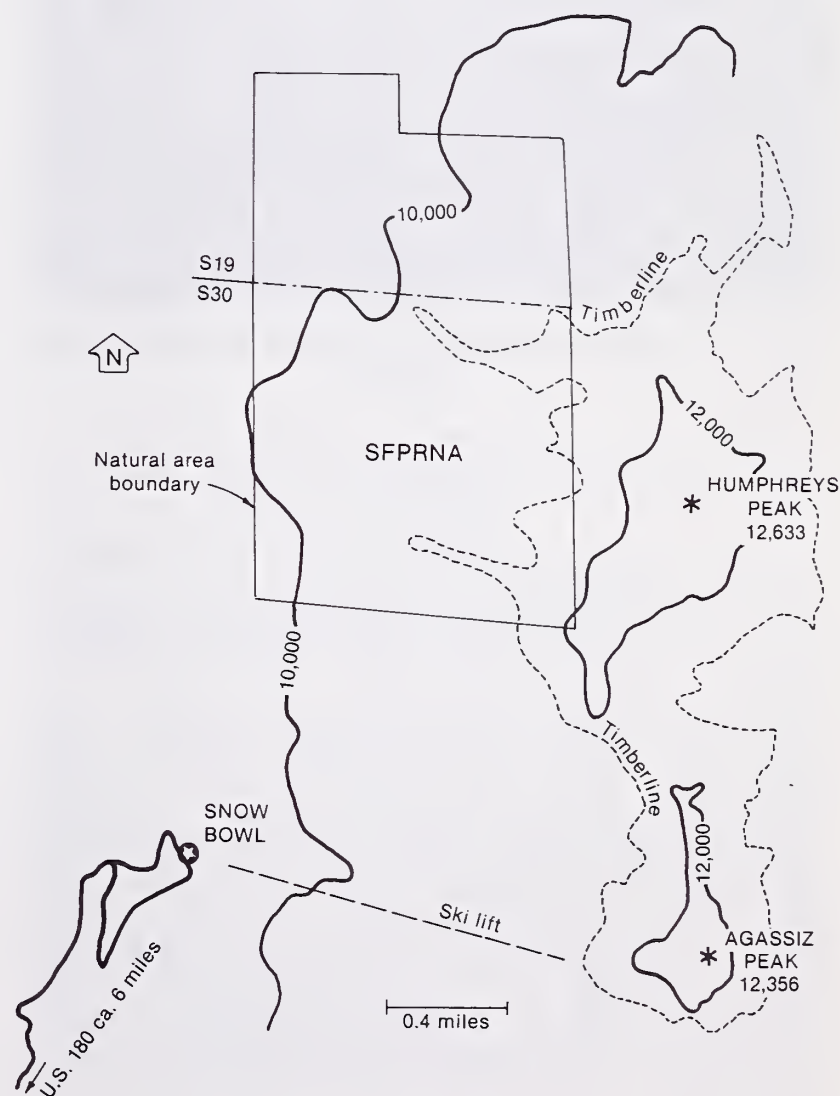


Figure 1.—Sketch map of the San Francisco Peaks Research Natural Area.



Figure 2.—View of the SFPRNA from Forest Service Road 418 in the fall.



Figure 3.—Closeup of four-inch pipeline in the White Horse Canyon.

METHODS

Eleven collecting trips were made into the SFPRNA during the growing season of 1980.⁴ These included one trip in June, four in July, four in August, and two in September. Snow covered much of the area above 11,000 feet until after mid-July.⁴ Field notes were recorded for each trip, and voucher specimens were filed at the Deaver Herbarium, Northern Arizona University, Flagstaff. Attempts were made to correlate field observations with habitat type (HT) descriptions of Moir and Ludwig (1979) for the San Francisco Peaks. Visual stem counts were made in mixed conifer and spruce-fir communities at elevational intervals of about 200 feet (60 m) to determine dominance. Notes were kept to indicate approximate elevation and slope exposure where one dominant species was replaced by another.

⁴Equipment carried on each trip included compass, altimeter, Humphreys Peak Topographical Quadrangle map, aerial photos of the area, camera, trowel, and plant collecting bags.

Aerial photographs taken of the area in 1967 were enlarged (to the scale of 8 inches = 1 mile) and used in the preparation of the vegetation map. The boundaries of both aspen and alpine tundra communities were determined from these.

RESULTS AND DISCUSSION

The major portion of the SFPRNA is covered by a mixture of Engelmann spruce and corkbark fir (*Abies lasiocarpa* var. *arizonica*), but there are also significant stands of bristlecone pine and aspen (*Populus tremuloides*), as well as a small area of alpine tundra.

Field studies in this area resulted in the collection of 129 species from 89 genera and 43 families of vascular plants. In her thesis study of the previous year, Paulik (1979) reported 189 species for the subalpine as a whole. There are several reasons for the smaller number of species found in the Natural Area: (a) the area is much smaller, with some habitats greatly reduced; (b) no part of the Inner Basin, which has several species unique to it, is within the Natural Area; and (c) of the 189 species previously collected, 17% or 33 species were considered weedy or introduced and were found primarily around the Arizona Snow Bowl lodge or along hiking trails. Disturbances of this kind occur much less frequently in the Natural Area, and thus few weedy species were recorded.

The plant collections also produced four previously unreported records for the San Francisco Peaks. Timber oatgrass (*Danthonia intermedia*) was formerly reported only from the White Mountains and the Mogollon Rim in wet meadows and pine forests (McDougall 1973). Mountain trisetum (*Trisetum montanum*) was known only from Apache County. Whortleberry (*Vaccinium oreophilum*) was known only from the White Mountains. Now, all three can be included in the San Francisco Peaks flora. Over's goosefoot (*Chenopodium overi*) appears to be an introduced species not previously reported for the subalpine zone of the Peaks.

The presence or absence of the proposed endangered species reported for the area was also noted. The subalpine buttercup (*Ranunculus inamoenus* var. *subaffinis*) is fairly common in moist to mesic meadows throughout the Natural Area. The alpine groundsel (*Senecio franciscanus*) though not as common as the buttercup, was not difficult to find on the gravelly talus slopes of the alpine and upper subalpine area.

Based on plant collections, field observations, and literature studied, nine plant communities are recognized within the boundaries of the SFPRNA. These are described in some detail below and are outlined on a vegetation map in appendix II. The communities are named for the dominant plants in each and are based on Moir and Ludwig's (1979) habitat type studies, indicated by HT, and the vegetation classification system of Brown et al. (1979).

In the description of the plant communities, common names and/or acronyms are sometimes used for con-

venience. The major trees and dominant herbs for which the plant communities are named are listed in table 1.

Table 1.—Scientific name, acronym, and common name of the major trees and dominant herbs of the nine plant communities of the SFPRNA

Scientific name	Acronym	Common name
<i>Picea engelmannii</i>	PIEN	Engelmann spruce
<i>Abies lasiocarpa</i> var. <i>arizonica</i>	ABLA	Corkbark fir
<i>Populus tremuloides</i>	POTR	Aspen
<i>Pinus aristata</i>	PIAR	Bristlecone pine
<i>Geum rossii</i> var. <i>turbinatum</i>	GERO	Mountain avens
<i>Primula parryi</i>	PRPA	Parry's primrose
<i>Carex bella</i>	CABE	Beautiful sedge
<i>Muhlenbergia montana</i>	MUMO	Mountain muhly
<i>Lathyrus arizonicus</i>	LAAR	Arizona peavine
<i>Erigeron superbus</i>	ERSU	Showy fleabane

Plant Communities

1. *Picea engelmannii*/Moss (PIEN/MOSS) HT

This HT, covering over 400 acres, ranges from 10,000 to 11,000 feet and dominates the west-facing slopes at the upper middle elevations (fig. 4). Engelmann spruce are largest in diameter (d.b.h.) and outnumber corkbark fir by at least three to one. The understory varies according to available light, with Arizona peavine (*Lathyrus arizonicus*) prevailing in forest openings. Under a closed canopy, which typifies this HT, herbaceous vegetation is sparse, with mosses and lichens providing most cover (fig. 5). The herbs seen most frequently are wild strawberry (*Fragaria ovalis*), fireweed (*Epilobium angustifolium*), mountain parsley (*Pseudocymopterus montanus*), orange sneezeweed (*Helenium hoopesii*), and green gentian (*Swertia radiata*). Predominant shrubs are gooseberry current (*Ribes montigenum*), orange gooseberry (*Ribes pinetorum*), and bearberry honeysuckle (*Lonicera involucrata*). Below 10,000 feet, Engelmann spruce begins to give way to corkbark fir, the codominant tree which is present throughout the HT. On higher and wetter sites, the PIEN/GERO HT replaces it. Below, it merges into the ABLA/LAAR HT. Occasionally limber pine (*Pinus flexilis*) is encountered on exposed ridges.

2. *Picea engelmannii*/*Geum rossii* (PIEN/GERO) HT

On wetter, north-facing slopes, this HT dominates. Its elevation is generally higher than PIEN/MOSS HT, ranging from 10,500 to 11,500 feet. This HT contains nearly pure stands of Engelmann spruce with occasional corkbark fir. The soil is moist and snow covered until early July. The herbaceous cover is dominated by mountain avens (*Geum rossii*)⁵ in association with a variety of species also found in the adjacent alpine tun-

⁵Mountain avens is correctly named *Geum rossii* (R. Br.) Ser. var. *turbinatum* (Rydb.) C. L. Hitchc., (Lehr and Pinkava 1980), and is the equivalent of *Geum turbinatum* Rydb. as treated by McDougall (1973), Kearney and Peebles (1960) and Lehr (1978).



Figure 4.—*Picea engelmannii*/Moss HT at about 10,500 feet.



Figure 5.—Closeup of *Picea engelmannii*/Moss HT.

dra, including Jacob's ladder (*Polemonium delicatum*), franciscan bluebells (*Mertensia franciscana*), golden columbine (*Aquilegia chrysantha*), and alpine fescue (*Festuca ovina* var. *brachyphylla*).

3. *Abies lasiocarpa*/*Lathyrus arizonicus* (ABLA/LAAR) HT

On west-facing slopes at lower elevations, this HT dominates. Ranging from 9,500 to 10,000 feet, it is the dominant HT where the road from Bismarck Lake enters the forest. In the SFPRNA, perhaps one-third of this HT is in a seral stage dominated by aspen, particularly in Section 19. Corkbark fir outnumbers Engelmann spruce by about five to one, but a few large, mature spruce are present. The understory is dominated by Arizona peavine in the openings, with a sparse scattering of the following herbs: Richardson's geranium (*Geranium richardsonii*), starflower (*Smilacina stellata*), wintergreen (*Pyrola* spp.), spotted coral root (*Corallorhiza maculata*), meadow rue (*Thalictrum fendleri*), creeping barberry (*Berberis repens*), and fringed brome (*Bromus richardsonii*).

4. *Abies lasiocarpa*/*Erigeron suberbus* (ABLA/ERSU) HT

In the northwest corner, the terrain is interspersed with several shallow canyons paralleling White Horse Canyon, all of which slope abruptly to the northwest. In this area, Douglas-fir (*Pseudotsuga menziesii*) makes its only appearance in the SFPRNA. It is the largest tree in this community, but corkbark fir is greatest in density. Douglas-fir may represent a seral stage that is gradually being replaced by corkbark fir. Douglas-fir is most abundant on south-facing slopes at elevations below 9,400 feet. Limber pine and corkbark fir are present on west-facing slopes, and Engelmann spruce becomes a major component on north-facing slopes. White fir (*Abies concolor*), which is a frequent inhabitant of such a mixed coniferous forest in Arizona, is notably absent. Understory vegetation is a mixture of showy fleabane (*Erigeron superbus*), wintergreen, starflower, creeping barberry, Richardson's geranium, Canadian violet (*Viola canadensis*), sweet cicely (*Osmorhiza depauperata*), and fairybells (*Disporum trachycarpum*). Several interesting shrubs are found on the north side of White Horse Canyon; these include Scouler's willow (*Salix scouleri*), service berry (*Amelanchier utahensis*), mountain ash (*Sorbus dumosa*), and rock spiraea (*Holodiscus dumosus*). The only collection of whortleberry was made at 9,500 feet in White Horse Canyon.

5. *Pinus aristata* community

This bristlecone pine community is found on south-facing ridges and talus slope edges at elevations between 10,500 and 11,500 feet (fig. 6). Occasionally Engelmann spruce and limber pine are intermixed. Except for sporadic shrub cover of common juniper (*Juniperus communis*) and gooseberry currant, there is a very sparse understory. The few herbs present are wild candytuft (*Thlaspi fendleri*), yellow draba (*Draba aurea*), Whipple's beardtongue (*Penstemon whippleanus*), and alpine fescue. The bristlecone pines are widely spaced and stunted at higher elevations. This community repeatedly appears on the north edges of talus slopes, which are the warmer and drier sites.

6. *Populus tremuloides* subclimax community

Extensive stands of aspen are found within the ABLA/LAAR HT, and a few arms extend upward into the PIEN/MOSS HT (fig. 7). These are seral stages, presumably following fire. Herbaceous cover varies greatly in response to the percentage of canopy cover. Under a relatively open canopy, Arizona peavine forms a luxuriant growth with a mixture of silvery lupine (*Lupinus argenteus*), American vetch (*Vicia americana*), Parry goldenweed (*Haplopappus parryi*), squirreltail (*Sitanion longifolium*), and fringed brome. Under a more closed canopy, such mesic species as starflower, creeping barberry, wintergreen, and baneberry (*Actaea arguta*) are found. Comparison of 1980

field observations of the aspen stands (taken from both Kendrick Park and Kendrick Mountain) with 1967 aerial photographs showed a decline in size of the aspen communities. Direct observation, on the ground, indicated very good regeneration of corkbark fir and Engelmann spruce beneath the aspen. Assuming no new fire damage occurs, these aspen communities may be replaced within the next 50 years. Depending on altitude and slope exposure, the true climax will be either Engelmann spruce or corkbark fir.

7. *Geum rossii*/*Carex bella* community

True alpine tundra is found in the southeast corner and extends downward on the exposed talus slopes in Section 30 (fig. 8). A small patch of tundra is also found on the exposed talus slope in the southeastern part of Section 19. This community is found mostly above 11,000 feet. It is dominated by mountain avens with a mixture of sedges, the most prevalent being the beautiful sedge (*Carex bella*). Other components of this community are sticky Jacob's ladder (*Polemonium viscosum*), moss campion (*Silene acaulis*), mountain sorrel (*Oxyria digyna*), painted alumroot (*Heuchera versicolor*), alpine groundsel, queen's crown (*Sedum rhodanthum*), spike trisetum (*Trisetum spicatum*), and spreading wheatgrass (*Agropyron scribneri*). At the lower extremes of the talus slopes in Section 30, a more dense shrub cover appears. This shrubby cover includes common juniper, gooseberry currant, red elderberry (*Sambucus microbotrys*), and bearberry honeysuckle.

8. *Primula parryi* community

This Parry's primrose community (fig. 9), recognized by Paulik (1979), covers less than 0.1% of the Natural Area and is restricted to high altitude regions which have additional moisture from seeps or springs. Parry's primrose dominates in abundance, size, and aroma. One such area is found at the eastern edge of Section 19 in a narrow vertical strip of about 200 feet. Associated with this community are such rare species as nodding bluegrass (*Poa reflexa*) and pygmy saxifrage (*Saxifraga debilis*). Other more ubiquitous herbs are mountain avens, Franciscan bluebells, subalpine buttercup, and several sedges (*Carex* spp.). An abundant nurse crop of Engelmann spruce thrives here.

9. *Muhlenbergia montana*/forb meadow community

In the southwest corner at the lower end of the talus slope, there are a few grassy openings on southwest-facing slopes adjacent to an aspen stand. These meadows are dominated by mountain muhly (*Muhlenbergia montana*) mixed with forbs and grasses typically found in the Douglas-fir and ponderosa pine communities of lower elevation. Associated grasses include Arizona fescue (*Festuca arizonica*), pine dropseed (*Blepharoneuron tricholepis*), and squirreltail. Common forbs are American vetch and silvery lupine. This is the



Figure 6.—*Pinus aristata* community at about 11,500 feet.



Figure 8.—*Geum rossii*/*Carex bella* community, with pipeline running through it.



Figure 7.—View of White Horse Canyon and *Populus tremuloides* subclimax community.



Figure 9.— *Primula parryi* community.

Table 2.—Plant communities of the SFPRNA, their equivalent association designation by Brown et al. (1979), and area (acres) covered

Map number	Plant community	Equivalent from Brown et al. (1979)	Total area covered	Percent of total
1.	<i>Picea engelmannii</i> /Moss HT	121.311 <i>Picea engelmannii</i> - <i>Abies lasiocarpa</i> association	412	40.2
2.	<i>Picea engelmannii</i> / <i>Geum rossii</i> HT	121.312 <i>Picea engelmannii</i> assoc.	173	16.9
3.	<i>Abies lasiocarpa</i> / <i>Lathyrus arizonicus</i> HT	121.314 <i>Abies lasiocarpa arizonica</i> association	164	16.0
4.	<i>Abies lasiocarpa</i> / <i>Erigeron superbus</i> HT	121.314 <i>Abies lasiocarpa</i> 51 <i>arizonica</i> association		5.0
5.	<i>Pinus aristata</i> community	121.322 <i>Pinus aristata</i> assoc.	56	5.5
6.	<i>Populus tremuloides</i> subclimax community	121.316 <i>Populus tremuloides</i> subclimax association	82	8.0
7.	<i>Geum rossii</i> / <i>Carex bella</i> community	111.532 <i>Geum turbinatum</i> - <i>Carex bella</i> association	74	7.2
8.	<i>Primula parryi</i> community	111.052 Mixed Herb Series of Rocky Mt. Alpine Tundra	1	0.1
9.	<i>Muhlenbergia montana</i> forb meadow community	142.411 Mixed forb-grass assoc. of Rocky Mt. Montane grassland	1	.1
	Bare rock		10	1.0

only place in the SFPRNA that showed evidence of domestic livestock intrusion. A spring here is responsible for attracting cattle to this lush, grassy meadow at about 10,000 feet.

SUMMATION

Table 2 matches the plant community name used above with the corresponding association designation used by Brown et al. (1979); it also shows the amount of land area covered by the nine plant communities recognized.

Of the nine plant communities represented in the SFPRNA, the PIEN/MOSS HT is by far the most extensive. Second in size and sharing nearly equal acreage are the PIEN/GERO HT and the ABLA/LAAR HT. A casual visit to the SFPRNA gives the impression that the ABLA/LAAR HT is much more extensive than it actually is, as it lies along most of the western edge and must be passed through to reach other communities. The two smallest communities are the *Primula parryi* community and the *Muhlenbergia montana*/forb meadow community. Two communities which are particularly unique in Arizona are the *Pinus aristata* community (bristlecone pine) and the *Geum rossii*/*Carex bella* community (alpine tundra). These two communities are found nowhere else in the state of Arizona except on the San Francisco Peaks.

LITERATURE CITED

- Brown, D. E., C. H. Lowe, and C. P. Pase. 1979. A digitized classification system for the biotic communities of North America with community (series) and association examples for the Southwest. *Journal of Arizona-Nevada Academy of Science*. 14(1):1-16.
- Kearney, Thomas H., and Robert H. Peebles. 1960. *Arizona flora*. 1085 p. University of California Press, Berkeley and Los Angeles.
- Lehr, J. H. 1978. *A catalogue of the flora of Arizona*. 203 p. Desert Botanical Garden, Phoenix.
- Lehr, J. H., and D. J. Pinkava. 1980. *A catalogue of the flora of Arizona, Supplement I*. *Journal of Arizona-Nevada Academy of Science*. 15(1):17-32.
- Little, Elbert L., Jr. 1941. *Alpine flora of the San Francisco Mountain, Arizona*. *Madrono* 6:65-81.
- McDougall, W. B. 1973. *Seed plants of northern Arizona*. 594 p. Museum of Northern Arizona, Flagstaff.
- Merriam, C. H. 1890. *Results of a biological survey of the San Francisco Mountain region and desert of the Little Colorado in Arizona*. *North American Fauna* 3. 136 p., 13 plates, 5 maps. U.S. Department of Agriculture, Division of Ornithology and Mammalogy, Washington, D.C.
- Moir, William H., and John A. Ludwig. 1979. *A classification of spruce-fir and mixed conifer forest habitat types in Arizona and New Mexico*. USDA Forest Service Research Paper RM-207, 47 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
- Moore, Thomas C. 1965. *Origin and disjunction of the alpine tundra flora on San Francisco Mountain, Arizona*. *Ecology* 46:860-864.
- Paulik, Laurie A. 1979. *A vascular flora of the sub-alpine spruce-fir forest of the San Francisco Peaks, Arizona*. 94 p. M.S. thesis, Northern Arizona University, Flagstaff.
- Schaack, C. G. 1970. *A flora of the arctic-alpine vascular plants of the San Francisco Mountain, Arizona*. 107 p. M.S. thesis, Northern Arizona University, Flagstaff.
- Smith, E. Linwood. 1974. *Established natural areas in Arizona: A guidebook for scientists and educators*. 300 p. Planning Division, Office of Economic Planning and Development, Office of the Governor, Phoenix, Ariz.

APPENDIX A

Checklist of the Vascular Plants of the San Francisco Peaks Research Natural Area⁶

7. POLYPODIACEAE
Cystopteris fragilis (L.) Bernh. var. *tenuifolia* (Clute) Brown
8. PINACEAE
Abies lasiocarpa (Hook.) Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry
Pinus aristata Engelm.
Pinus flexilis James
Pseudotsuga menziesii (Mirb.) Franco var. *glauca* (Beissn.) Franco
9. CUPRESSACEAE
Juniperus communis L. var. *saxatilis* Pall. = (var. *depressa* Pursh)
18. POACEAE
Agropyron scribneri Vasey
A. trachycaulum (Link) Malte var. *glaucum* (Pease and Moore) Malte
A. trachycaulum (Link) Malte var. *latiglume* (Scribn. & Smith) Beetle
Agrostis exarata Trin.
Blepharoneuron tricholepis (Torr.) Nash
Bromus frondosus (Shear.) Woot. & Standl.
B. richardsonii Link
Danthonia intermedia Vasey
Festuca arizonica Vasey
F. ovina L.
F. ovina L. var. *brachyphylla* (Schult.) Piper
F. sororia Piper
Koeleria cristata (L.) Pers. = (*K. pyramidata* (Lam.) Beauv.)
Muhlenbergia montana (Nutt.) Hitchc.
Phleum alpinum L.
Poa fendleriana (Steud.) Vasey
P. interior Rydb.
P. pratensis L.
P. reflexa Vasey & Scribn.
P. rupicola Nash
Sitanion longifolium J. G. Smith
Trisetum montanum Vasey
T. spicatum (L.) Richt.
19. CYPERACEAE
Carex albonigra MacKenzie
C. bella Bailey
C. chalciolepis Holm
C. ebenea Rydb.
C. occidentalis Bailey
C. rossii Boott
C. siccata Dewey
C. wootonii MacKenzie
26. JUNCACEAE
Luzula parviflora Desv.
L. spicata (L.) DC.
27. LILIACEAE
Disporum trachycarpum (Wats.) Benth. & Hook.
Smilacina stellata (L.) Desf.
Zigadenus elegans Pursh
30. ORCHIDACEAE
Corallorhiza maculata Raf.
Goodyera oblongifolia Raf.
32. SALICACEAE
Populus tremuloides Michx.
Salix scouleriana Barratt
43. POLYGONACEAE
Oxyria digyna (L.) Hill
44. CHENOPODIACEAE
Chenopodium berlandieri Moq.
C. overi Aellen
50. CARYOPHYLLACEAE
Arenaria lanuginosa (Michx.) Rohrb. ssp. *saxosa* (Gray) Mag.
A. obtusiloba (Rydb.) Fern.
A. rubella (Wahlenb.) J. E. Smith
Cerastium beeringianum Cham. & Schlecht.
Silene acaulis L. ssp. *subcaulescens* (F. N. Williams) Hitchc. & Maguire
S. scouleri Hook. ssp. *pringlei* (Wats.) Hitchc. & Maguire
Stellaria umbellata Turcz.
52. RANUNCULACEAE
Actaea arguta Nutt.
Anemone globosa Nutt.
Aquilegia chrysantha Gray
Ranunculus inamoenus Greene var. *subaffinis* (Gray) L. Benson
53. BERBERIDACEAE
Berberis repens Lindl.
56. CRUCIFERAE
Draba aurea Vahl
D. crassifolia Graham
Thlaspi fendleri Gray
59. CRASSULACEAE
Sedum rhodanthum Gray
60. SAXIFRAGACEAE
Heuchera versicolor Greene forma *pumila* Rosendahl et al.
Ribes montigenum McClatchie
R. pinetorum Greene
Saxifraga debilis Engelm.
S. rhomboidea Greene var. *franciscana* (Small) K. & P.

⁶Numbering and sequence of plant families follows McDougall (1973) and Kearney and Peebles (1960).

63. ROSACEAE
Amelanchier utahensis Koehne
Fragaria ovalis (Lehm.) Rydb.
Geum rossii (R. Br.) Ser. var. *turbinatum* (Rydb.)
C. L. Hitchc.
Holodiscus dumosus (Nutt.) Heller
Potentilla diversifolia Lehm.
P. hippiana Lehm.
P. sibbaldii Hall. f.
Rubus strigosus Michx.
Sorbus dumosa Greene
64. LEGUMINOSAE
Lathyrus arizonicus Britton
Lupinus argenteus Pursh
Vicia americana Muhl.
65. GERANIACEAE
Geranium richardsonii Fisch. & Trautv.
74. EUPHORBIACEAE
Euphorbia lurida Engelm.
91. VIOLACEAE
Viola canadensis L.
97. ONAGRACEAE
Epilobium angustifolium L.
100. UMBELLIFERAE
Osmorhiza depauperata Phil.
Pseudocymopterus montanus (Gray) Coult. & Rose
103. ERICACEAE
Moneses uniflora (L.) Gray
Pyrola secunda L.
P. virens Schweigg.
Vaccinium oreophilum Rydb.
104. PRIMULACEAE
Androsace septentrionalis L.
Primula parryi Gray
110. GENTIANACEAE
Gentianella amarella (L.) Börner
G. barbellata (Engelm.) J. M. Gillett
Swertia radiata (Kellogg) Kuntze
114. POLEMONIACEAE
Polemonium delicatum Rydb.
P. viscosum Nutt.
116. BORAGINACEAE
Mertensia franciscana Heller
118. LABIATAE
Agastache pallidiflora (Heller) Rydb.
Monardella odoratissima Benth.
120. SCROPHULARIACEAE
Castilleja austromontana Standl. & Blumer
Pedicularis parryi Gray
Penstemon barbatus (Cav.) Roth
P. whippleanus Gray
Veronica wormskjoldii Roem. & Schult.
128. CAPRIFOLIACEAE
Lonicera arizonica Rehder
L. involucrata (Richards) Banks
Sambucus microbotrys Rydb.
Symphoricarpos parishii Rydb.
129. VALERIANACEAE
Valeriana acutiloba Rydb.
132. COMPOSITAE
Achillea lanulosa Nutt.
Agoseris arizonica Greene
A. aurantiaca (Hook.) Greene
Antennaria parvifolia Nutt.
A. umbrinella Rydb.
Erigeron flagellaris Gray
E. formosissimus Greene
E. simplex Greene
E. superbus Greene
Haplopappus parryi Gray
Helenium hoopesii Gray
Helianthella quinquenervis (Hook.) Gray
Senecio bigelovii Gray
S. franciscanus Greene
S. macdougallii Heller
Solidago decumbens Greene
S. multiradiata Ait.
Taraxacum officinale Weber

APPENDIX B

Vegetation Map of the San Francisco Peaks Research Natural Area



Rominger, James M., and Laurie A. Paulik. 1983. A floristic inventory of the plant communities of the San Francisco Peaks Research Natural Area. USDA Forest Service General Technical Report RM-96, 9 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

In this study area, covering 1,024 acres of alpine and subalpine vegetation on the west slopes of Humphreys Peak in Coconino County, Arizona, 129 species of vascular plants were found within nine plant communities or habitat types, as classified by Moir and Ludwig.

Keywords: Floristic inventory, research natural area, alpine vegetation, subalpine vegetation

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Rocky
Mountains



Southwest



Great
Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

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*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526